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BULLETIN

OF THE

Society for the Promotion of Engineering Education

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EDITORIAL.

Foreword.—The membership of the Society has now become large enough to warrant the officers in suggesting a monthly magazine devoted to technical education. During the present year the matter has been submitted to the members of the Council, most of whom favor a monthly publication if it is practicable to issue one. The matter has been carefully considered by the Executive Committee, and the secretary has discussed it with a number of members. As a result the Executive Committee authorized the publication of this sample number so that the members of the Society can see what such a publication would look like. The name "Bulletin" has been tentatively selected to distinguish the periodical from the annual volumes of Proceedings.

Practically every national society of any importance now publishes a monthly paper of some sort. When the membership of our society was small such procedure was out of the question, but now that a membership of one thousand could be easily reached through a determined effort on the part of the members, the case is very different. Through the coöperation of advertisers, it should be feasible to issue an unpretentious monthly Bulletin. A number of possible advertisers,

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were approached to learn if they would consider the Bulletin a profitable advertising medium. As this issue shows, several companies have considered it favorably. While these advertisers are in no way committed to assist in the support of the Bulletin, several have indicated their willingness to take space for the coming year if we decided to publish regularly.

The Council will consider the matter at their meeting on June 23, and the members would appreciate receiving opinions as to the desirability of issuing a monthly publication. The recipients of this issue are therefore requested to send either through the secretary or through friends in the Council their candid opinions and criticisms. Suggestions as to interesting features will also be very welcome. It is the desire of the Council to have the Society serve its members in every possible way. The attempt to produce a satisfactory monthly Bulletin should be considered from that standpoint.

Coöperation in Research.—One of the many ways in which the Society can be helpful to its members is through coöperation in research. One generally recognized function of the technical school is to add to the total of engineering knowledge. This function is performed with greater or less efficiency in all colleges, but through lack of definiteness of plan the results are not commensurate with the effort expended. In the manufacturing companies the case is different. There the aim is to secure design and other constants which may be used to reduce manufacturing costs. The object of research in technical schools is different. It is rather to study fundamental engineering principles, and to state these in usable terms for the benefit of all engineers. Still more important, it develops and stimulates the creative talent of advanced students so that when they take up practical work they will be constantly seeking improved methods of design, construction and operation. They will not be willing to continue obsolete practices, but will treat all of their work by the scientific method.

Different institutions have different men and different facilities for research. Research problems are being constantly suggested which cannot be solved with the resources at command. Through the Society, it should be possible to invite assistance in such work. A suggestion in the Bulletin might interest a research worker who would be delighted to have his attention drawn to a profitable line of study. Promising subjects might be listed from time to time.

Committee Reports.—National societies are coming to realize more and more that their best work originates in committees appointed for specific lines of investigation. A study of the files of our Proceedings shows this is the case in the Society for the Promotion of Engineering Education. The best way in which to get diligent and cheerful service from a society member is to appoint him chairman of a committee and then assign to the committee a task in which the chairman is interested. The other members act usually in an advisory capacity while the chairman furnishes the initiative and the perseverance. The report of the Committee on the Teaching of Mathematics to Engineering Students, which appears in preliminary form in this issue, illustrates the above contentions. This report, when finally adopted, is bound to have a lasting influence in promoting coöperation between the teachers of mathematics and the teachers of engineering. A full and frank discussion of the subject should be provoked by the report, upon which a great amount of labor has been bestowed.

Local Meetings.—One of the excellent suggestions which has been made recently is that the members of the different institutions or groups of institutions get together occasionally for discussion of local matters. We all agree that we value the Society partly for the delightful association of congenial men. Here we are all alike. There is no civil engi-

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neer, no mathematician, no dean, no instructor. All meet on the same social, official and intellectual plane. The secretary has written to individuals at a number of our institutions asking them to try the plan. It may be desirable to have flexible and simple local organizations, simply to get people together now and then. There are plenty of subjects to talk about and there are plenty of people who like to talk. All that is needed is a little ingenuity and persistence to secure some excellent results.

A Clearing-house for Facts Regarding Our Technical Schools.—There is a real need for some medium of communication between teachers of engineering, by means of which they can learn of each other's development. Many teachers spend much time and money in visiting schools other than their own largely to learn what these are doing and how they are doing it. This visiting will always be desirable and necessary, but it is cited to indicate the desire for knowledge of men and methods. In this issue of the Bulletin are contained a few notes which show what could be done if a systematic effort were made to collect such information. The secretary has inquired if teachers at the different centers will be willing, if called upon, to supply items of interest. In general they have returned a hearty assent.

THE CONVENTION.

It is not yet possible or desirable to announce the complete program for the annual meeting. The indications are, however, that the program will be a full and interesting one. At least three important committee reports will be ready, namely, those on The Teaching of Mathematics to Engineering Students, on Entrance Requirements, and on Engineering Degrees. You already have copies of the second, the preliminary draft of the first is printed in the Bulletin, and the third will be distributed at or before the meeting. The symposiums on "Mathematics" and "Efficiency" promise to be lively discussions of live topics. Among the papers are the following: "The Harvard Plan," by Dean W. C. Sabine; "Technical Education in Germany," two papers, one by Dean Geo. H. Shepard, the other by Mr. Frank Koester, consulting engineer; "The Recent Inspection Tour of the Ohio State University Students," by Professor W. T. Magruder; "Technical Education in China," by Professor Walter H. Adams; "Inspection Trips for Technical Students," by Professor G. C. Shaad; "The Teaching of Judgment," by Mr. E. J. Kunze; "Character Training," by Dean J. P. Jackson.

President L. R. Van Hise, of the University of Wisconsin, will welcome the Society to Madison and will also deliver a public address on "The Conservation of our Natural Resources" during the meeting. President Munroe's address will be introductory to the symposium on efficiency.

The local committee, under Dean F. E. Turneaure, has laid out a delightful program of social events which will charm, without exhausting the members. The members will probably be quartered in one of the women's dormitories, and no effort will be spared to get all well acquainted. The campus is one of the finest in the world and in itself is well worth a long journey.

THE DEVELOPMENT OF THE ENGINEERING COLLEGE OF THE UNIVERSITY OF WISCONSIN.

BY DEAN FREDERICK E. TURNEAURE.

The College of Engineering of the University of Wisconsin, like the engineering schools of so many of the states, owes its origin to the Morrill act providing for instruction in agriculture and mechanic arts. A state university had already been established in 1848, and the new schools of agriculture and engineering thus provided for by the federal government, were wisely attached to the already existing institution. Thus Wisconsin is one of the few states in which all state-supported instruction of the college or university grade is combined into a single large institution.

Like most such schools established at that time the engineering department had for many years a slow growth. Its courses at the outset were composed largely of scientific and general studies with a minimum of engineering application. Courses of civil and mechanical engineering were provided for at an early period and a reasonably well equipped shop was established. By the year 1890 the number of engineering students had grown to about 150, the total number of students in the university being about 900.

A considerable improvement in the faculty was brought about in 1890 and 1891 by the establishment of additional chairs, and in particular the chair of electrical engineering. In 1898 the number of students had reached 250, and the quarters provided had become very inadequate. The increasing importance of the department led to its being organized into a separate college at this time, and the appointment of its first dean, the late J. B. Johnson. One of the first efforts of the new dean was towards the securing of appropriations from the state for a new building for the College of Engineering. After some strenuous work an appropriation of

$100,000 was obtained, which provided for a satisfactory building for offices, recitation rooms, drafting rooms and some of the laboratories. The erection of this building marked an important period in the history of the college, and from that time its growth has been very rapid in every way. In 1905 a course in chemical engineering was established and in 1909 a complete course in mining engineering so that at present five regular engineering courses are offered. The number of students has steadily grown to about 900 and the instructional staff in the technical departments now numbers about 60.

As related to other departments of the university, the College of Engineering constitutes one of five coördinate branches; namely, the College of Letters and Science, the College of Agriculture, the Law School, the College of Medicine and the College of Engineering. Within the college the organization is built upon somewhat different lines than is usual in engineering schools, and corresponds more closely to the departmental organization in colleges of arts and science. It is the theory of the organization that the departmental unit is determied by the nature of the study itself rather than by the curriculum or group of studies prescribed for students; and that, having established a department, all students desiring instruction in that particular field of knowledge should receive their instruction from that department. Thus it has come about that in the College of Engineering there exist eleven independent departments of instruction, as follows: Drawing and descriptive geometry, pure and applied mechanics, including phsyical properties of materials, topographical and geodetic engineering, railway engineering, structural engineering, hydraulic engineering, steam and gas engineering, machine design and mechanical practice, electrical engineering, chemical technology, and mining metallurgy. Each department is composed of a professor in charge, with such assistant professors and instructors as the requirements of the case may determine. This organization seems to be a natural one and has some advantages over the more

common one in the greater independence given to the departments for development, especially in regard to advanced and graduate instruction. At the same time it places the full responsibility for all instruction in any particular line of study upon a department which is expected to be expert in its own special field.

Along with many other engineering schools, the members of this faculty have considered seriously the subject of advanced courses of study. As a result of this consideration there has been established a group of advanced four-year engineering courses, which require for admission one year of college work subsequent to the usual four-year high school course. These advanced courses lead to the professional degree. The time which is gained by this advanced preparation is used in the four-year course to include some additional technical work and some further studies of a general nature, the subject of economics being required. A considerable number of students have registered during the past year with a view to pursuing this advanced course.

During the past few years there has been a very great increase in the amount of advanced and research work carried on by graduate students and members of the instructional staff. This work is greatly aided by a special fund of $4,500 a year, which has been granted the College of Engineering for research work. These funds are expended mainly in the preparation of material for publication and for the services of certain special assistants that have been employed temporarily from time to time. The research work thus carried on has resulted in several contributions of considerable value, especially in the field of reinforced concrete and hydraulic engineering. The results have been published partly as University bulletins and partly in transactions and technical periodicals. To still further encourage advanced work the college offers three graduate scholarships of a value of $225 each, and two fellowships of a value of $400 each.

The latest addition to the facilities offered engineering students is the new Forest Products Laboratory of the U. S.

Forest Service. The laboratory building has been supplied by the state at a cost of about $45,000 and was opened for operation June 4. The operations of the laboratory are conducted by a large technical staff from the Forest Service of the U. S. Department of Agriculture. Coöperative arrangements exist between the laboratory and the university, whereby students in the university may carry on advanced and special studies in the laboratory under the direction of the laboratory staff. Four regular courses of instruction in various branches of wood technology have been definitely arranged for and will be given next year by members of the laboratory staff. These are intended, primarily, for students in mechanical and chemical engineering who desire to prepare themselves for work in the wood manufacturing industries. Supplementing these, the department of machine design will offer a course in wood manufacturing machinery.

The members of the Society, who will be in attendance at the meeting in June, are cordially invited to inspect the various laboratories of the College of Engineering and, in particular, the new Forest Products Laboratory here referred to. The Faculty of the College of Engineering appreciate the honor of having Madison selected as the place of meeting this year, and hope the pleasure of our guests will be as great as that of the host.

PRESIDENTIAL ADDRESS. (Abstract.)

BY PROFESSOR HENRY S. MUNROE.

The president purposes to make use of his address to open the discussion on "Efficiency in Engineering Education." Efficiency is today recognized as the key-note of success in all lines of human industry. Efficiency means economy of time and economy of effort. This is true of all work, whether of machines, of animals or of men. It is emphatically true of brain work.

The study of efficiency that now engrosses the attention of industrial leaders and efficiency engineers, and the rapidly increasing volume of literature on this interesting and all-important topic, contains much that is of interest to us as educators, and from which we may draw valuable suggestions for our work.

The first phase of the subject proposed for discussion touches the root of the whole matter. If we agree to measure the efficiency of an educational institution, and the efficiency of instructors, by the percentage of students who complete their courses of study with credit, we shall at once realize the importance of training students to make the best use of their time and opportunities.

The second phase of the subject is no less important. Students must not be discouraged by asking of them more than they can accomplish. They must not be forced to devote undue attention to one subject and to neglect other subjects because of the unequal demands of their instructors. They must not be overworked on some days of the week, or during some of the years of their course, and have little to do on other days or in other years.

There is no better way of encouraging, guiding and controlling the work of students than by systematic tests of progress made. Such tests should be frequent and the mark of approval or disapproval should follow promptly. Procrastination must be discouraged and regular and systematic work promoted.

Instruction by lectures has been the subject of much criticism, both constructive and destructive. For many subjects it remains the most effective method of imparting knowledge, economizing the time and energy of the student, and enabling the instructor to exercise personal influence on his class possible in no other way. Many devices are in use to overcome the very evident shortcomings of this method of instruction, to strengthen its weak points, and to enlarge its sphere of usefulnesss.

If we consider the relative advantages of the lecture and

recitation from the standpoint of the student, and the best and most effective use of his time, we must limit instruction by lectures to subjects in which information can be conveyed better and quicker by lectures than by individual study, and use text books, recitations and problems to encourage careful and effective study of other subjects. In many cases a judicious combination of the two methods will give the best results.

The educational value of laboratory, drafting room, shop and field instruction is very great. This method of teaching is so effective, and the results are so immediate and satisfactory, that there is always the temptation to give it too large a place in the curriculum. It is possible to make instruction too practical.

It is a serious question whether original investigation should find place in a professional school. Such work has great educational value but it may easily absorb far too much of the student's time and energy. The time available for professional training is none too much and it is a question whether we can afford any large part of it to work of this character. On the other hand, the graduation thesis may be used to review the work of previous years, enabling the student to discover and strengthen the weak points in his training, giving him valuable insight into the kind of work that he will have to do on graduation, and giving him a certain confidence in his ability to do such work.

THE CONVENTION SYMPOSIUMS.

President Munroe has sent to the members two letters intended to stimulate interest in the symposiums on "Mathematics" and "Efficiency." The bodies of these letters are given here for convenient reference.

1. What proportion of the students in engineering schools, who have completed the required work in calculus, are able to apply that knowl edge and solve simple, practical problems?

2. What proportion of the graduates of engineering schools, who receive instruction in calculus and in its application to mechanics, thermodynamics and engineering, are capable of using calculus as a tool, readily, with difficulty, or not at all?

In all cases where I have put these two questions the answer invariably has been, that the percentage of students who can make use of the calculus is very small, ranging from two to ten per cent. This indicates to me that the instruction in calculus fails lamentably in securing the desired results, which suggests the following further questions.

3. Is the proportion of students who can utilize their knowledge of calculus materially above the average in any institution in the country? If so, why?

4. Is it possible to increase the efficiency of instruction in calculus in one or more of the following ways:

(*a*) By omitting certain portions of the calculus as now taught and concentrating the work on a more limited field so as to secure better results?

(*b*) By abandoning the highly theoretical treatment of the subject and teaching it as arithmetic is taught in the elementary schools, with very limited emphasis on the theoretic side and major emphasis on its practical application? We do not instruct children in the theory of numbers, but give them practical rules for addition, subtraction, multiplication, division, etc. The result is that the large majority of those studying arithmetic are able to use these rules successfully in every-day life.

5. Is it desirable or necessary to provide additional time for instruction in calculus, and should this instruction extend through two, three or four years of the engineering course? Should this additional instruction be entrusted to the Department of Mathematics, to the Department of Mechanics, or to the Engineering Departments, and in what proportion?

6. Is it desirable or necessary to give instruction in other branches of higher mathematics to students in engineering schools, and if so, what additional subjects should be taught and how much time should be allotted to each respectively?

I feel that no more important subject than the one above outlined for discussion has come before the Society since its organization. If the failure to secure adequate results is due to insufficient time given to the subject, I feel strongly that we must increase the time given, even to the extent of eliminating some of the higher studies in engineering. Calculus is a subject that can not well be acquired by the student after he leaves the engineering school, while engineering studies can be pursued to any extent desired in after life.

The subject of efficiency may be discussed under the following heads:

1. Organizing and systematizing the work of the students; methods of arousing their interest and of encouraging them to make the best use of their time and opportunities.

2. Organizing and systematizing the work of instructors so that each department of study shall have its due share of the student's time and energy, and no more.

3. Conduct of recitations and examinations, control of outside reading, study, and problem work so to secure the best results.

4. Improvement of lecture instruction; use and abuse of lectures; utilization of syllabi, indices, bibliography and encouragement of outside reading; lecture illustration, experiments, use of blackboard, models, diagrams, lantern slides, economy of student's time and energy and methods of securing his attention in lecture period. Advantages and disadvantages of printed lecture notes.

5. Relative advantages and disadvantages of lectures and recitations. Subjects suited to one or the other method of instruction. Limitations of each method.

6. Improvement of laboratory instruction; in the preliminary preparation of students, in the supervision of laboratory work, in the character of the work required, in facilities for work, in reports of work done, and deductions therefrom.

7. Improvement in shop work instruction. Relative importance of manual training and study of actual shop practice. Should manual training form any part of the curriculum?

8. Organization of vacation work. Assignment of time to different subjects. Utilization of time to best advantage. Class work versus individual study. Should students be encouraged to seek remunerative employment by allowing academic credit for such work?

9. Graduation theses. In what ways can these be made more useful?

10. Original investigation. Is it desirable to have the graduation theses involve original investigation by the students?

LIMITATIONS OF EFFICIENCY IN ENGINEERING EDUCATION.*

BY GEO. F. SWAIN,

Professor of Civil Engineering, Harvard University.

Our colleges, universities and technical schools are at the present time the subject of serious criticism at the hands of many writers, some of them high in authority in educational matters, some of them outsiders with no teaching or experience, who judge of the work of the schools by the men that are turned out. Even the presidents of some of our educational institutions, if they have been correctly reported, admit that much of the development of the last few decades has been, if not in the wrong direction, at least incomplete or unsymmetrical, and that important modifications need to be made in regard to methods of instruction and administration, as well as in matters of general educational policy. Critics outside the teaching profession, joining in the complaint, have pointed out what they consider serious faults, and have indicated how, in their opinion, our colleges should be reorganized.

Measuring Efficiency.

The engineer, in estimating the performance of a machine, measures its value by what is termed its "mechanical efficiency." This is the ratio of the effective work done by the machine to the energy which is put into it. The higher the efficiency the better the machine. The efficiency of a business may be measured somewhat in the same manner; in this case best, perhaps, by the ratio of net earnings to the total investment, provided that the investment has been properly expended. Of course, one business cannot in this way be compared directly with another on the same basis, for in one sort

* These notes are abstracted from the address delivered by Professor Swain at the recent opening of the new Carnegie Engineering Building of Union University. The address is printed in full in *Engineering News*, Vol. 63, p. 548 (May 12, 1910).

of business the possible net earnings may be far smaller compared with the total investment than is the case in another kind of business. Nevertheless, there is a sort of measure, even if rough compared with the mechanical one. That measure is expressed in dollars. Since dollars are desirable or necessary to those who have invested in the concern, if a low efficiency is shown—lower than should reasonably be expected, or lower than is shown in similar concerns similarly situated—there will probably be a demand for a change of management.

I have often asked myself the question: what is the efficiency of education? Unfortunately, however, there is no measure for that efficiency. The manufacturer takes the raw material out of which he manufactures his product—a log of wood, for example;—he pays for this raw material and for the labor expended upon it, in money; fashions it into the form desired, and sells it for other money. The efficiency of the entire process can be measured, if not with exactness, at least approximately.

It is essential, before judging of the real value of higher education, to estimate the necessary limitations of efficiency, to consider the inevitable losses and sources of waste, and thus to refer the final product, not to a purely theoretical and impossible maximum, but to a practically attainable one; in other words, to consider the reasons for the observed defects, and to ascertain to what extent they are practically remediable.

The reasons for these defects seem to arise from four main reasons: 1, the student; 2, the parent; 3, the teacher; 4, the administration.

Passing over the first two topics which are treated fully in the original address, we may proceed at once to (3) and (4) as bearing most directly upon the present symposium.

Defects in the Instruction.

While the main difficulty, in my opinion, lies with the student himself, and with his parents, there is undoubtedly, in most cases, just room for criticism of the teaching in our

schools. Among the defects commonly found, a few may be mentioned:

1. There is too great prevalence of courses which are information courses only, and a lack of realization on the part of the teacher that his main object should be to teach the student to think. We may well reflect upon Locke's statement that the objects of education in their relative rank are as follows: (1) virtue, (2) wisdom, (3) good breeding, (4) learning.

Learning—to which we almost confine our attention—placed last. And even with reference to learning, we often misplace the emphasis. The student must of course be taught many facts, but the main emphasis should be laid upon the use which is made of those facts. Logical thinking is the main object. If the student gains this, he can reason upon new facts and in any subject; if he does not, he simply uses in a rule-of-thumb way the few specific facts which he has learned.

2. There seems to me to be an undue use of the lecture system. This is a very serious evil, in my opinion, and unfortunately it seems to be increasing and to be extending even into the secondary schools. A young man may be interested and may gain some information by listening to a lecture, but he will not gain much mental training. The use of lectures without text-books seems particularly futile, except, perhaps, in some special subjects. The student should have a text-book which he is required to study. The exercises in the class room should consist in finding out whether he has studied it and mastered it, and if not, why not; and a certain portion of time should be taken in enlarging and explaining the subject itself.

3. Another fault, which seems very common, is that no attention is paid in many institutions to teaching the students how to study. Young men, animated with the best intentions, work hard but ineffectively in the endeavor to master the subjects presented to them. It is not sufficiently realized that hard work is not alone what is needed, and will never bring a man success unless it is also effective work. A man should train himself to work like a well-oiled machine, accomplishing

a result easily, quickly, and without friction. Some instruction with reference to the proper methods of study would seem to be essential, yet I have rarely known of such instruction being given.

4. Equally striking is the fact that in many institutions no attempt is made to teach methods of reasoning in general, except in so far as it is done in connection with the special courses. In the Middle Ages, logic occupied an important part in higher training, and it was generally taught in universities up to within a few decades. Since that time it seems to have largely disappeared, and in some of our higher schools little or no attempt is now made, except as already stated, in connection with individual courses, to teach the student the general rules of correct reasoning; in other words, the principles of logic.

5. A further difficulty in education arises from the difficulty of obtaining good teachers, and in some cases from the practical impossibility of getting rid of poor ones. A large part of the difficulty is no doubt due to the enormous increase, within the past few decades, in the number of teachers required, corresponding to the remarkable growth of high schools and the enormous expansion of colleges and universities. For instance, in 1860 the number of high schools in the United States was 44; in 1870, 160; in 1880, 800; in 1890, 2,526, and 1900, 6,005. In 1908 the number of teachers in our higher schools, including colleges, was about seven times what it was in 1870. There appears to be a real difficulty in obtaining competent teachers for the schools and colleges, particularly in view of the fact that the remuneration offered in this profession is much less than that which a capable man may expect to obtain in business or in any of the other professions.

6. Another common defect in our teaching methods appears to be a lack of coördination. In many of our higher institutions, each teacher seems to be an unrestrained individual, following his own way, not only *teaching* his own subject in such manner as he pleases, but arranging his course and plan-

ning the ground to be covered without regard to anybody else. This criticism, if justified, is more apt to be applicable to our colleges than to technical schools in which a required curriculum is prescribed and in which there must be a sequence of studies; but even in these there appears to be some room for improvement.

Defects Due to Administration.

With reference to administration, the fundamental limitation to efficiency seems to me to lie in a fact which has already been referred to, namely, that the administrators—that is to say the trustees—have no financial interest at stake. This is the fundamental difference between the administration of a college and the administration of a business concern. Where men have no financial interest they cannot be expected to fully realize the responsibility, nor will they be apt to energetically take the necessary steps to insure efficiency. For this reason, among others, I do not believe that education ever can be as efficient as business. Without concentration of responsibility, efficiency is undoubtedly diminished, and without direct financial interest, responsibility will not be heavily assumed. When we combine a lack of direct financial interest in the product of education with the fact that the efficiency of the process is entirely intangible and incapable of any concrete expression, and the further fact that responsibility is divided, we have a combination which necessarily ensures a small percentage of efficiency—which constitutes its principal necessary limitation.

Conclusions.

I have endeavored to outline what the engineering graduate should be; what he unfortunately too often is; and have referred to some of the difficulties which are met in endeavoring to reach the ideal. Many of my remarks apply, of course, with even greater force to the college graduate also. The remedies, so far as remedies are possible, which have occurred to the writer have already been partially suggested. They may be summarized as follows:

1. Every student in a university or technical school should be given systematic physical training and instruction in physiology.

2. Education should not be considered to be merely mental education. Moral development should be kept constantly in mind and every teacher should not only endeavor to make himself a moral example, but, as far as consistent, to inculcate moral lessons.

3. Educational work is not consistent with such concentration of responsibility as is possible in business, but it should be striven after so far as possible.

4. Every effort should be made to cause the student to see the necessity for self-discipline and self-exertion, to realize the value of his opportunities, the importance of cultivating proper mental, moral and physical habits, the fact that his success will depend upon himself alone, the necessity of studying how to work *effectively* and not simply *earnestly*. If he does not reasonably appreciate these things and take advantage of his opportunities, he should be promptly taken out of college and set to work earning his own living. Both parents and colleges are too lenient toward the indolent and the inefficient.

5. Courses and examinations should be arranged, so far as possible, with the main object of training the student to observe and to think, and also, to a sufficient extent, to manipulate. It should be made impossible to pass in a course by rule-of-thumb work, mere memorizing, or cramming.

6. The lecture system should be reduced to a minimum, so far as practicable.

7. Students should be taught how to study, how to work effectively, and how to think logically. The systematic study of logic, in some form, might well be required in any engineering course.

8. Teachers, at all events in the early portions of their careers, should be willing, and not only willing but glad, to submit to some scrutiny of their methods and results, should welcome kindly criticism, should discuss and study educa-

tional methods, and should be willing to modify their own methods. There should be cordial sympathy and harmony between the members of the faculty, and a spirit of earnest coöperation.

9. Every student should be obliged to follow a carefully planned curriculum, involving continuous and systematic mental discipline. This does not mean that every student should follow the same curriculum, but that each man's course should be systematic in itself.

10. Students in colleges and technical schools should not idle away their summer vacations, but should devote them entirely or largely to work of some kind. The other vacations during the year are sufficient for the physical needs of boys of eighteen or over. Summer work should be either at shop work or at summer engineering camps, or in actual shops or other engineering establishments, where the student will see the opportunities for the practical applications of science, and will also learn that ability and wisdom are not confined to men who go to college, and that if he would surpass the untutored man in the race of life it must be by getting an education.

But when all is said and done, the necessary limitations to efficiency in education will remain, these being largely due to the student himself and his lack of will, to the parent, who has given the boy no home discipline in the days of childhood, to the lack of financial incentive, and to the fact that efficiency cannot be measured.

Our colleges, no doubt, have serious defects—more serious on account of the extraordinary rapidity of their growth. But they are earnestly engaged in the attempt to solve a great problem. They may go wrong, they undoubtedly will go wrong at times, but they will discover their mistakes and correct them so far as practicable. They need in many respects to be reformed, and where they need it they will be reformed. Thy have, on the whole, done much good work, together with considerable poor work, but they will do better and better work as the years go by.

CONTRIBUTION TO THE DISCUSSION OF EFFICIENCY IN ENGINEERING EDUCATION.

BY PROFESSOR V. KARAPETOFF,

Professor of Electrical Engineering, Cornell University.

The word "efficiency" may here have several meanings, for instance:

1. The ratio of the useful information and mental training actually offered by a college to that which an ideal college should offer.

2. The ratio of the amount of knowledge and mental development actually acquired by the student, to the amount of the opportunities offered by the college.

3. The ratio of the use made by the student of his college education during his professional career, to the potential energy stored in him at the time of graduation.

The foregoing statements can be represented more briefly by formulæ, as follows:

1. Efficiency of curriculum $= \dfrac{\text{what is offered}}{\text{what should be offered}}$;

2. Efficiency of teacher $= \dfrac{\text{what and how he teaches}}{\text{what and how he should teach}}$;

3. Efficiency of student as receiver $= \dfrac{\text{what he assimilates}}{\text{what the college offers}}$;

4. Efficiency of student as giver $= \dfrac{\text{what he will give to the country}}{\text{what he has received from the college}}$.

A comparison to a power plant suggests itself, with separate efficiencies of its parts: prime movers, electric generators, transmission lines, etc.

The factors which affect the above-mentioned are considered separately below.

1. *Efficiency of a curriculum,* as defined above, depends chiefly upon the following factors:

(*a*) Personality of the dean; his experience and tact; his ability to steer among conflicting influences, and to guide

without directly imposing his views; to select the nucleus of the faculty; to inspire the teachers to do their best, and to work in unity and harmony.

(*b*) Engineering and pedagogical experience of the leading professors; their ability to select and to correlate properly the courses of instruction, and to arrange schedules that neither overload nor underload an average student.

(*c*) Correctness of educational aims and ideals in the college as a whole.

(*d*) Funds available for the equipment and for teachers' salaries.

(*e*) Methods of instruction in use: For instance, recitations *vs.* lectures; abundance or scarcity of time devoted to shops and laboratories; preponderance of practical information, or of pure theory, etc.

(*f*) Outside influences, and competition with other schools.

2. *The efficiency of a teacher* depends on a rather subtle psychological make-up of the man; a good teacher is a born teacher, because teaching is essentially an art. A few requirements for an efficient teacher of engineering are:

(*a*) Ability to impart knowledge; this ability is partly instinctive, partly scientific (psychology of education).

(*b*) A thorough knowledge of the subject, and its proper correlation with the adjacent branches of engineering and of natural sciences.

(*c*) A sufficient practical experience in engineering work. This makes the presentation of the subject more convincing and interesting.

(*d*) A sound knowledge of current literature on the subject, and of the trend in the specialty (up-to-dateness).

(*e*) Ability to enthuse and to inspire the student by the teacher's own life and research.

(*f*) Practice of devoting summers to engineering work in the specialty.

(*g*) Good voice, directness of delivery, refined manners, orderly clothes; absence of any habits that induce students to make fun of the teacher.

(*h*) Ability to see sympathetically the student's point of view, and to judge his degree of understanding.

(*i*) Diligence and conscientiousness; deep desire to see his work done in the best possible way.

3. *Efficiency of the student as receiver* of the knowledge imparted to him depends upon the following factors:

(*a*) The order in which different subjects and parts of a subject are taught; the manner of presentation and the personality of the teacher. These factors are enumerated above.

(*b*) The mental ability of the student.

(*c*) His interest in the subject.

(*d*) His diligence, conscientiousness and strength of character (disturbing influences at the house where he rooms).

(*e*) The particular subject which he has selected as his specialty.

(*f*) The necessity of earning his living, or, on the contrary, too much money sent from home.

The overall efficiency of the college "plant" is equal to the product of the efficiencies denoted by (1), (2), and (3) above:

$$\text{overall efficiency} = \frac{\text{what the student has assimilated}}{\text{what an ideal college should offer}}.$$

This overall efficiency depends upon many factors, some of which are enumerated above. Before attempting to reform something in a college, the relative importance of a particular factor upon the efficiency must be correctly estimated. The same amount of effort and expense directed towards the elimination of another undesirable factor may raise the overall efficiency much more. Thus, to use an analogy, a small auxiliary pump in a large power plant may be not quite efficient; but if its steam consumption is but one tenth of a per cent. of that of the whole plant then even a considerable saving on this one item would not improve the economy of the station to any perceptible degree. And if the manager and the superintendents should devote most of their time and thought to this one pump, forgetting its relative importance, more harm would be done than good.

ABSTRACTS OF PAPERS.

System and Efficiency in Technical Instruction.*

BY PROFESSOR S. E. SLOCUM,

Professor of Applied Mathematics, University of Cincinnati.

The present demand for industrial and social efficiency has resulted in a new estimate of educational values. The idea of industrial coöperation between school and shop indicates the trend of secondary and technical education when worked out along these lines. As a consequence of this new educational aspect, traditional ideas as to the function of the teacher have been greatly modified, increasing emphasis being placed on his efficiency in obtaining results of commercial value.

In this paper are discussed various methods for systematizing technical instruction with a view to increasing its efficiency and economic value. The general discussion consists of two parts: (A) Systematizing the work of the class room, (B) Coördination of technical instruction with actual shop practice.

Under the first heading is discussed the general propositions on which a systematic layout of class work is based, with brief discussions of the limitations and proper field of the methods in common use, and suggestions for supplementing and modifying the same so as to increase the effectiveness of instruction.

Under the second heading is outlined the application of industrial coöperation as carried out by the author with his classes in technical mechanics. The basis on which the coördination between class room and shop is effected is explained, with a summary of actual results obtained. The method adopted for coördination is perhaps unique in that it consists

* This paper will form a part of the symposium on efficiency.

of an interweaving of theory and practice, rather than coupling the two in series or parallel as ordinarily attempted.

German Technical Universities.

BY GEORGE H. SHEPARD, M.M.E.,

Dean of the L. C. Smith College of Applied Science,
Syracuse University.

The paper consists of a report of observations made during the summer of 1909 on the methods of six of the great German technical universities, of comparisons of the observed methods with American methods, and of recommendations of some modifications in the latter.

The writer holds that the advantage of more advanced entrance preparation on the part of the German is, for the present at least, compensated by the earlier arrival of the American at the productive stage of his career, and recommends no advance in American entrance requirements at present.

The writer finds that German candidates for the first degree in either electrical or mechanical engineering must have at least one year's practical experience, and that circumstances usually compel at least half the year to be taken before matriculation. The writer finds that the German schools profit greatly by this practical experience of their students, and recommends that American schools make the same requirement. The writer states a plan by which the student can fulfill this requirement, and still arrive at the productive stage of his career at the same age as at present.

The German system of complete student liberty is compared with the American system of faculty supervision.

The work and status of the German professor are compared with those of the American.

The greater productiveness of new knowledge, on the part of the German technical university, than of the American, is discussed, and reasons for it are explained; the means to bring up American performance in this respect are suggested.

THE TEACHING OF "JUDGMENT."

BY EDWARD J. KUNZE,

Instructor in Steam and Gas Engineering, University of Wisconsin.

Judgment is one of the greatest assets of the engineer. Without judgment he is no engineer. It is usual to consider the acquirement of judgment as a part of the training which the engineer is to receive after he has graduated from college. My thesis is that judgment can and should be taught during the college course.

Judgment cannot be taught from a text book; it cannot be learned by means of lectures, nor can it be acquired by recitations. There are two methods of acquiring judgment; first from one's own experience; secondly, from the observation of the experience of others. In practice we usually find judgment acquired by a combination of these two methods. Obviously if the number of subjects is large or if they vary greatly, the first method would consume entirely too much time. In teaching judgment, we must, therefore, chiefly consider the second method.

The engineer due to his training naturally takes the attitude of comparison and criticism toward all methods and objects. If therefore, we bring together matters having a common purpose in general, but whose specific conditions may change, or if we gather together matters representing the views of others, in such a manner that they may be readily compared, we have a basis for the formation of judgment. In examining any properly classified set of objects, tables or other data the observer will at once note that a difference exists, he will then search for all the details which differentiate one illustration from another and he will ask himself why do these parts differ, what determined each designer for instance, to make up his part as illustrated, etc. It is but a small step from this point to that in which the student will form an opinion of his own and then judgment in this particular phase has been born.

Comparison is most effective when graphs or pictorial illustrations are employed, since most persons are predominately eye-minded. They are therefore employed as far as possible.

A few illustrations will suffice to point out applications of the above suggestions: Illustrations of a part of an engine, such as a "slipper" cross-head, gathered from any available source, may be gathered together and pasted or sketched on a loose-leaf note sheet. The loose-leaf sheet permits of perfect flexibility, but in every case care should be taken to keep the illustrations on any one sheet all of the same subclass, separate sheets being used for turned, planed and winged cross-heads, etc.

Likewise collections made of radial drills, valves, steam separators, cranes, etc., when properly subclassed and arranged on sheets so that they may be spread out before the observer, all tend to cultivate judgment on matters pertaining to the particular subject at hand. Likewise a table may be constructed showing the allowable stresses, the factors of safety, etc., for different parts of machines. Such a table will act as a check on one's work, and will form judgment in matters not directly in the field covered by the table. Judgment on proper methods of manufacture may be formed by the use of a table showing the cost of manufacture of, for instance, a gas engine cam, when made singly, in lots, and by special machinery. In fact, more or less judgment on any subject may be created by gathering together on a few sheets the experience of perhaps a number of men and comparing them.

Inspection Trips for Technical Students.

BY GEO. C. SHAAD,

Professor of Electrical Engineering, University of Kansas.

There are usually one or more of three general objects in view in organizing inspection trips: inspiration and observation of general features, learning of details, gathering material for report writing. They benefit both the student and the instructor.

The section or sections of the country to be visited depend upon the location of the school and the particular object in view. For inspiration an extended trip is desirable, travel has its own educational value, but for collecting detailed information shorter and more frequent trips are to be preferred.

The plants to be visited should present as large a variety as practical and should, as a whole, be representative of their class. For the gathering of detail the first plants or industries should not be too large or complicated. On extended trips the student may, on certain days, be separated according to the courses they are following.

Careful organization and attention to details are necessary for a successful trip, either local or extended. There should be sufficient instructors with each party, say not less than one instructor to every eight or ten students. With a large group of students arrangements for quickly dividing it into smaller parties, as is desirable in many cases, should be made.

Inspection trips are desirable for all engineering students but of most value to seniors or advanced juniors. Some trip or trips should be made compulsory but in this case it may be desirable, on account of students who are working their way, to offer optional trips which do not call for heavy traveling expenses.

Some care is necessary to see that the student gets as much as possible out of his inspection of any plant or industry. As much general information in regard to the particular plant to be inspected as is practical should be given him beforehand; questions which are liable to come up later should be answered; and instruction as to the points of particular interest should be given previous to entrance to the plant. Where detailed information is wanted particular care should be taken in the organization of the groups and in conducting them through the establishment. Proper class room instruction will cause the men to be on the lookout for different things they have learned about but have never before had the opportunity of seeing. Careful and systematic notes are

necessary where details are desired and information not readily available from inspection should be promptly and accurately given by the instructor in charge.

A written report of some nature should be required for inspection trips and considerable care should be exercised in the review of this report. It should be criticised from the standpoint of organization and arrangement of material, of facts presented, of English used, and of the appearance of the report as a whole. The preparation of a technical description of a power plant gives excellent training in the writing of engineering reports.

Cooperative Work for the Wisconsin Railroad and Tax Commissions.*

A symposium of brief papers on this topic will be presented by Professors W. D. Pence, J. G. D. Mack and C. P. Burgess, of the University of Wisconsin. The plan is as follows:

A. Historical and descriptive, by W. D. Pence, Professor of Railway Engineering.

B. Mechanical Features, by J. G. D. Mack, Professor of Machine Design.

C. Gas and Electric Service, by C. P. Burgess, Professor of Chemical Engineering.

* Professor Pence calls attention to the fact that there are two commissions, the titles of which are apt to be confused.

COLLEGE NEWS.

Alabama Polytechnic Institute.

The William LeRoy Broun Engineering Hall now in process of erection for the Alabama Polytechnic Institute, at Auburn, Alabama, is expected to be completed and ready for use by January 1, 1911. It will have about forty-three thousand square feet of floor space and will furnish lecture rooms, drawing rooms, offices, and partial laboratory facilities for the departments of civil, electrical, mechanical, and mining engineering, and the department of mechanical drawing and machine design. Plans and estimates are being made for new shops and boiler house and it is hoped that the next Legislature will provide funds for their erection.—J. J. W.

Case School of Applied Science.

Professor J. D. Batchelder, professor of Spanish and French, Dr. H. B. North, instructor in chemistry, and Mr. A. F. Blaser, instructor in civil engineering, have resigned. Mr. Chas. F. Nevin, B.A. (Harvard 1902), graduate student at Harvard and former instructor at Bucknell and New York universities, will fill the vacancy in the Modern Language Department, while the instructorship in Chemistry will be filled by Mr. Fred H. Heath, Ph.D. (Yale 1909), assistant for two years at Yale and at present instructor at Massachusetts Institute of Technology. Mr. Blaser's place is yet to be filled. The graduating class this year numbers eighty members, of which 23 are graduated in civil engineering, 18 in mechanical engineering, 16 in electrical engineering, 13 in mining engineering, 1 in physics, and 9 in chemistry. In addition, 3 receive the degree of C.E., 3 of M.E., 1 of E.E., and 1 of M.S. in chemistry.

Columbia University.

The University Council and Trustees of Columbia University have authorized the president to open negotiations with

other colleges and universities looking toward the further extension of the so-called combined academic and professional school course, first inaugurated at Columbia in 1890 and now widely spread throughout the United States. The combined course permits students while in college to elect as part of their undergraduate work subjects in law, medicine or engineering, and thus to shorten the time necessarily devoted to obtain both the academic and professional degrees. So far as the relations existing between the college and professional school of any single university is concerned, the combined course works smoothly and well and presents no problem not easily solved. Students who have part of their training at one institution and part in a professional school connected with some other institution usually have to sacrifice the baccalaureate degree if they desire to shorten the combined course of study. It is, therefore, desirable to formulate some course of action by which such students can obtain both degrees, the first degree being given preferably by the college at which the student takes the major part of his academic course, giving credit for the work done in the professional school. The same result can, of course, be secured if he receives both degrees from the university where he takes his professional studies. Columbia University is loath to take this latter course if the other plan can be brought into successful operation. It is believed that if a number of universities shall agree to adopt such policy the educational interests of the whole country will be advanced.

Members of the Society desiring further information regarding the movement should write to the secretary of Columbia University for a copy of the report of the committee on education of the trustees on the extension of the combined college and professional school course.—H. S. M.

Cornell University.

Henry S. Jacoby, the professor of bridge engineering in the College of Civil Engineering of Cornell University, has been granted a sabbatic leave of absence for the first half of

the next academic year. He expects to leave home on July 1, and to devote the following seven months to travel in the United States and Canada, to visit the bridge departments of various railroads and municipalities, and to inspect some important bridges and other structures.—H. H. N.

Harvard University.

We are now preparing our curriculum for our Graduate School on the basis of three years in addition to the college course. That is to say, if a man takes his degree in three years he can get the master's degree here in three years more. If an exceptional man should specialize in his college course, taking engineering subjects, and graduating in three years, he might be able to get our master's degree in five years; in that case, however, he would have to specialize to such an extent that he would not be able to get in much more than what is required in the ordinary technical school, so that his course would practically be a four years course in a technical course with a post graduate course of one year. Only the exceptional man could do this, and to do it at Harvard he would have to get a good many of the liberal studies by doing much more work than the ordinary student is required to take. The members of the Society may be interested in the rules adopted by the Faculty of Arts and Sciences on Dec. 14 and 21, 1909. The rules are given below.—G. F. S.

Rules for the Choice of Electives

I. Every student shall take at least six of his courses in some one department, or in one of the recognized fields for distinction. In the latter case four must be in one department. Only two of the six may be courses open to freshmen or distinctly elementary in character.

II. For purposes of distribution all the courses open to undergraduates shall be divided among the following four general groups. Every student shall distribute at least six of his courses among the three general groups in which his chief work does not lie, and he shall take in each group not less than one course, and not less than three in any two groups. He shall not count for purposes of distribution more than two courses which are also listed in the group in which his main work lies.

The groups and branches are:

1. Language, literature, fine arts, music.
(*a*) Ancient languages and literatures.
(*b*) Modern languages and literatures.
(*c*) Fine arts, music.
2. Natural sciences.
(*a*) Physics, chemistry, astronomy, engineering.
(*b*) Biology, physiology, geology, mining.
3. History, political and social sciences.
(*a*) History.
(*b*) Politics, economics, sociology, education, anthropology.
4. Philosophy and mathematics.
(*a*) Philosophy.
(*b*) Mathematics.

The committee was granted authority to arrange the various courses under the different groups and subgroups by agreement with the departments in which the courses are given.

III. Prescribed work shall not count either for concentration or distribution.

Lehigh University.

Two new laboratories are now in process of erection at Lehigh University, to be known as the Fritz Engineering Laboratory and the Eckley B. Coxe Mining Laboratory.

The Fritz Engineering Laboratory.—The Fritz Engineering Laboratory was designed by Mr. John Fritz, of Bethlehem, well known as the father of the steel industry in the United States, and a member of the board of trustees of Lehigh University from its founding. The laboratory will be equipped with a general testing section for the testing of materials of construction, a cement and concrete section, a hydraulic section, and a road materials section. The building is completed and the equipment will be installed before the opening of the college year in September next.

The Eckley B. Coxe Mining Laboratory.—The Eckley B. Coxe Mining Laboratory is so named in memory of one who was universally recognized as a pioneer and a leader in the profession of mining engineering in this country and who was an active friend and valued trustee of the university from its early days.

Tau Beta Pi Society.—The annual convention of the honorary technical society, Tau Beta Pi, in celebration of the

twenty-fifth anniversary of the founding the Society at Lehigh University by Professor Edward H. Williams, Jr., was held at Lehigh University on June 9 to 11. Appropriate commemorative exercises were arranged, and, in addition to business meetings, visits of inspection were made to the local steel and cement industries.

THE PLANET LEHIGH.—The elements of the orbit of the minor planet Taunton 94, discovered by the Rev. Mr. Metcalf, the eminent astronomer of Taunton, Mass., have been worked out by Mr. J. B. Reynolds of the teaching staff of Lehigh University under the direction of Professor J. H. Ogburn of the department of astronomy. In recognition of this work the discoverer has arranged that this planet shall be officially known as "Lehigh."

NEW COURSE IN ELEMENTARY PHYSICS.—All engineering students at Lehigh University take elementary physics throughout the freshman and sophomore years, one lecture per week during the two years, an average of two and one fourth recitations per week for the two years, and an average of two and one-fourth hours per week of laboratory work for the two years. The course is consecutive from beginning to end. The first year is devoted to mechanics and heat and the second year to electricity and magnetism and light and sound. About two thirds of the laboratory time, however, is devoted to mechanics and heat. Electrical and mechanical engineering students take an advanced course in the theory of electricity and magnetism in the junior year and an advanced course in electrical laboratory work in addition to the elementary work of the freshman and sophomore years.

NEW COURSES IN SCIENCE.—Four courses leading to the degree of bacheor of science have been established at Lehigh University and and will be offered next September for the first time. These include:

1. A course in which the biological and chemical sciences dominate.

2. A course in which the geological sciences predominate.

3. A course in which the mathematical and physical sciences dominate.

4. A course in business administration.

THE CONFERENCE DEPARTMENT.—A new departure has been inaugurated at Lehigh University in the establishment of what is called a conference department, in which provision is made for conference between students and instructors on Wednesday and Saturday afternoons, and special assistance in the form of extra recitations given for a small fee on Monday, Tuesday, Thursday and Friday evenings. The object in view in the establishment of this department has been to aid students who have difficulty with the current work.—W. S. F.

MONTANA STATE COLLEGE.

On May 20 the college held the third electrical show under the auspices of the electrical engineering department. The exhibits were apparently instructive and interesting. Several social features contributed to the success of the occasion. It would be interesting to learn if other colleges have tried the same plan in their electrical or other departments.—ED.

NORTH CAROLINA AGRICULTURAL AND MECHANICAL COLLEGE.

The matter of most interest at this time is the starting of a $50,000 engineering building. The ground was broken for this on May 3 and the laying of the concrete foundation was to begin to-day but rain did after all intervene. This will be a two-story building with a large basement. It will be built entirely of reinforced concrete and will house the departments of Chemistry, Civil Engineering and Electrical Engineering. The building is 170 by 90 feet and comprises two stories and basement.—W. H. B., JR.

PENNSYLVANIA STATE COLLEGE.

The college is graduating this year the first two men in the course in industrial engineering which was described in a paper before the Society at its last meeting by Professor Diemer. This course is planned primarily to train for the manufacturing departments of industrial establishments. As a result of sending out a bulletin descriptive of the course as

it is given, to some of the manufacturers who suggested its introduction, the college has had requests to furnish eleven graduates when only two are available. Professor Diemer, through the McGraw-Hill Book Company, expects to publish at an early date, a text on "Factory Organization and Administration."—Ed.

Syracuse University.

Professor Nugent, of the department of civil engineering, has devoted much time during the last year to the plans for the new hydraulic laboratory. It will be ready for use next fall. Mr. L. C. Smith, who founded and gave the original equipment for the College of Applied Science at Syracuse will equip this new laboratory.

At least three months of experience in practical engineering work is a new requirement in all the engineering courses. This work is to be done during the summer vacations and a correspondence course conducted by the faculty is to be taken in connection with it.

The department of electrical engineering is constructing a 60,000-volt, 5 kw. testing transformer.

A new course in the calculation of alternating current problems has been introduced.

The equipment of the new hydraulic laboratory will afford opportunity for more extended work in hydro-electric engineering.

George Goldman, University of California, formerly with the General Electric Company, Hudson River Power Company and the Pittsburg Transformer Co., has been made assistant professor of electrical engineering.

Associate Professor R. A. Porter, who has had charge of the work in electrical measurements for nearly eight years, has been granted a year's leave of absence for study in Germany. His place will be taken temporarily by W. D. Harris, University of Nebraska.

Union University.

On April 28 the new engineering building, presented by Mr. Andrew Carnegie, was dedicated. The cost of the building was $100,000 and the alumni have contributed an equal sum for endowment in accordance with the terms of the gift. An abstract of the address delivered by Professor Geo. F. Swain is given elsewhere in this issue. This abstract is presented in connection with the symposium on "Efficiency."

University of Florida.

The form of organization recommended by the Association of State Universities has recently been adopted by the University of Florida. In accordance with this, its engineering courses are organized under a College of Engineering, within the university. Professor J. R. Benton has been requested to act as dean for this college. Its enrollment for the present college year is forty-three.—J. R. B.

University of Kansas.

We expect to instal within the next six weeks a small sewage treatment plant on our campus for experimental purposes. Our electrical laboratories are to be moved into new quarters for this fall and their equipment increased by the expenditure of about $10,000. The School of Engineering has occupied its new buildings during this past year, greatly to its advantage in both space and equipment. These improvements have increased the efficiency of our engineering work. We have new mechanical, road, sanitary, cement, testing and mining laboratories and have increased equipment in other lines.—F. O. M.

University of Mississippi.

We have inaugurated a plan here which we hope will tend to raise the professional ideals of our students, not only those of the engineering department, but of the other professional departments as well, and in addition will tend to bring about a common interest as between the members of the various

professional departments. The plan is to have the students of each professional department take lectures, especially designed for them, from various members of the faculties in the other departments, these lectures bearing particularly upon the connection between the two departments concerned. For instance, the writer has just finished a course of eight lectures to the members of the law classes on the history and laws of public land surveys and on expert testimony. This will be repeated next year. At the same time, a member of the law faculty will deliver to the engineering students a course of lectures on contracts, bearing particularly on that class of contracts which an engineer meets most in his experience. Carrying out this same idea, we will exchange lectures with members of the medical faculty, it now being the plan for a member of the engineering faculty to deliver to medical students a few lectures on sewage treatment, garbage disposal, ventilation of buildings, medical electricity, and other similar subjects, while the medical faculty will deliver to the engineering students lectures on zymotic diseases, bacteriological analysis, etc. The plan is not yet in full operation, but, as far as it has gone, it seems to be doing great good in broadening the professional ideas of the students of the various departments, and in enhancing their interest in their own work by disclosing to them its vital connection with the work of the other professions.—W. H. D.

University of North Dakota.

The College of Mechanical and Electrical Engineering of the State University of North Dakota which in the past has conferred the professional degrees of M.E. and E.E. upon the completion of a four year curriculum, will beginning with the class entering next year confer the degrees of B.S. in M.E. or E.E. upon the completion of the four-year curriculum and the professional degrees of M.E. and E.E. upon the completion in *residence* of a five-year curriculum. The advanced work for this degree can not be done in absentia. During the past year this college has been equipped with a 50-H.P. suc-

tion down draft gas producer, a 55-H.P. producer gas engine and a 70-H.P. mechanical stoker has been installed for one of its laboratory boilers with a view to investigating the best methods of utilizing the North Dakota lignite coal of which there is an unlimited supply.—C. H. C.

University of Washington.

The new electrical laboratory of the University of Washington, which, from points of equipment, space and convenience, offers new and enlarged opportunities to students of electrical engineering, occupies the south half of the main floor of Machinery Hall and a part of the second floor and basement. The south end of the main floor is partitioned off into five rooms, one of which is used for instrument making and repairing, another for a shop, a third for an instrument room, the fourth for a telephone room, and still another for thesis and general research work along electrical lines. Of the remaining space the seniors occupy the east side for the alternating current work, and the juniors the west side for direct current work.

The laboratory, when finished, will consist of ten complete sections, five A.C. and five D.C. sections, each of which is supplied with four machines of various types and makes, and a switchboard independent of all others. With two students working together in each section, the space will accommodate twenty students at one time. An excellent assortment of electrical machines is contained in this laboratory and the general plan commends itself as admirable.—Ed.

University of West Virginia.

Our mining department has been strengthened recently by the addition of Professor R. B. Brinsmade, B.S. (Washington University), E.M. (Lehigh '95). Professor Brinsmade has had engineering experience for fifteen years in the mines of South America, Canada and the United States.

Several valuable pieces of apparatus are being added to our steam and electrical equipment. The installation of a 100-H.P. Westinghouse steam turbo-generator is nearly com-

pleted. This set is supplied with a Westinghouse water brake, a Wheeler surface condenser, a motor driven Edwards air pump, a Westinghouse LeBlanc condenser (motor driven), and a Worthington jet condenser. The turbine may be supplied with saturated steam or superheated steam from a separately-fired Foster superheater, recently installed. Our steam equipment will also be improved by the addition of some apparatus for testing steam separators. Another room has been added to the electrical engineering laboratory since January 1. This will be used largely for electrical mining machinery. It is now being equipped with a 20-K.W. 110- to 250-volt motor-generator set. This set is connected to a four-panel, 90-inch, blue Vermont marble board, which is equipped with the best Westinghouse instruments and with circuit breakers and switches for each branch circuit. To this mining electrical equipment has been added a motor-driven chain coal cutter, a rotary coal drill, and several motors. This laboratory has been planned for elaborate extensions in the future. To the regular electrical engineering equipment has just been added a complete set of Westinghouse precision meters with multipliers, etc., and fourteen of the finest round-pattern meters of the same make. Our facilities for alternating current work have been enhanced by the addition of a motor-driven, 20-K.W., 2-phase, variable frequency alternator, now being installed.

University of Wisconsin.

The University Extension Department of the University of Wisconsin was organized in its present form in the fall of 1907; over 3,500 students are at present enrolled. Nearly 2,000 are engaged in special studies of an engineering or technical nature. The organization at present includes but two districts, and covers about one fifth of the state—one district with headquarters at Milwaukee, the second, at Oshkosh. In these two districts classes have been formed and are met regularly by instructors from the university, while

the resident instructor is always available for personal consultation and assistance. In the Milwaukee district in less than two years over one thousand students have been enrolled in vocational subjects. The courses taken include: shop mathematics, mechanical drawing, gas engines, electricity, business management, accounting, commercial law, and other subjects of like practical bearing.

The students in the course on gas engines, many of whom are college graduates, have been granted permission to conduct experiments in the municipal fuel laboratory. These experiments are under the personal charge of Professor Norris, of the extension department, and he is assisted by Professor Kowalke, of the chemical engineering department. It is thus recognized by the city administration, that this technical work is of practical value to the city. All members of the Society for the Promotion of Engineering Education who will attend the next meeting of the society at Madison, Wis., are respectfully urged to investigate the methods of the extension department. The offices of the department will be open and explanation of the organization and methods of procedure, cheerfully given.—L. E. R.

Washington University.

On February 8, 1910, Dean Calvin M. Woodward tendered to the trustees his resignation from the Nathaniel Thayer Professorship of Mathematics and Applied Mechanics, the deanship of the School of Engineering and Architecture, and the directorship of the Manual Training School, to take effect on the above date. With the exception of five weeks (when off duty on account of a broken arm) Dean Woodward has given the university forty-five years of continuous service. He intends to devote the next two years to work on a textbook of "Applied Mechanics," which he aims to make his best gift to the students of engineering. Professor A. S. Langsdorf becomes dean of the School of Engineering.

Yale University.

Two graduates of the Sheffield Scientific School of Yale University, Mr. George G. Mason, of New York, and his brother, Mr. William S. Mason, of Evanston, Ill., both of the class of 1888, have given $250,000 for the construction and equipment of a new mechanical engineering laboratory, and the board of trustees has provided the land for the site. The new laboratory will be located on Hillhouse Avenue nearly opposite the Leet Oliver Memorial Building. It will have a frontage of about 85 feet on Hillhouse Avenue, extending back 200 feet, with a rear entrance on Temple St. It will be four stories in height. It will be constructed of Indiana limestone and brick and contain approximately 50,000 square feet of floor area and 880,000 cubic feet of space. The entire equipment will be new, and will consist of the most modern appliances for assisting the student in studying those fundamental principles of applied science which are closely related to mechanical engineering, such as the strength of materials, the combustion of fuel in furnaces and in internal-combustion engines, the making of steam in boilers of different types, the using of saturated and superheated steam in engines or steam turbines, the artificial production of cold, the production, transmission and use of compressed air, the pumping of water, the transmission of power, and the problems of heating and ventilation. Besides furnishing a modern laboratory for undergraduate instruction, it is hoped that when it is suitably equipped it will be the means of encouraging graduates of the school to remain for four years of work, and, with the opportunities available, research work in engineering science may be carried forward by research fellows and members of the staff of the department. It is expected that the plans will be ready so that work on the laboratory may be begun by next July and the building completed and equipped by June, 1911. —L. P. B.

A Novel Plan for Descriptive Geometry Problems.

Professor Victor T. Wilson of the Michigan Agricultural College has devised a novel plan for use in connection with instruction in descriptive geometry. The need for the plan and a few details are here given.

The teacher of graphics who reflects about it, no doubt has found a difficulty in his work because it takes so much time for students to lay out on paper the given data upon which the problem is to be solved. This is particularly true in such a subject as descriptive geometry, perhaps also in kinematics and machine design.

Teachers might welcome a plan which would eliminate this delay and permit the maximum of time for the solution of problems. The following is such a plan which is about to be put into operation, at first for descriptive geometry.

An exceedingly large number of layouts—and by "layout" is meant the given conditions of problems—and also of problems to be solved are to be put on the market in catalogue form. A teacher who wishes to use them will make a selection of the problems to fit his requirements—and the number will be so large that he will have no difficulty in choosing from them. He can then order these printed on one of several kinds of paper, the same will be executed and shipped promptly to whomsoever he may designate as his representative.

The problems will be so catalogued that all the necessary information about them can be ascertained at a glance, including the size of space required for the solution; the statement of the requirements of the problem can be added if desired in type in any chosen place on the sheet, a border line can be printed if desired, and the whole made so complete that it can be placed in the hands of the student ready for the real work or problem solving and at a cost of but a few cents more than the cost of the paper.

A few details of interest may be here added:

The problems will be arranged in any desired manner on the sheet, in any size sheet up to 12 inches by 18 inches, statements to be printed with problems or not, or upon separate problems sheets, in black or colored inks as desired. The cost for variations in ink will be a minimum, and that of the different sizes of sheet will be about the difference in cost of the paper.